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ASTROSCOPE™ NIGHT VISION

HOW TO USE NIGHT VISION WITH A DIGITAL SLR AND MIRRORLESS CAMERA

AstroScope™ for Nikon Mirrorless Cameras

AstroScope™ for Canon Mirrorless Cameras

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Today's digital SLR and mirrorless cameras offer the photographer full control of aperture, shutter speed and ISO settings enabling the capture of excellent usable images in low light that were not otherwise possible. However, in many situations such as photographing scenes at night with very little ambient light, or telephoto photography at night at a distance, even the best digital SLR and mirrorless cameras simply do not have sufficient sensitivity to capture adequate images. In these situations, night vision modules such as those described here are the ideal accessory. This article provides important guidelines for producing awesome night-time photos when using a night vision module-enabled digital SLR and mirrorless camera.

By adding a night vision module to a digital SLR and mirrorless camera, night turns into day. Follow these guidelines to assure the best possible image quality.

Because of the increased availability of high performance digital SLR and mirrorless cameras, capturing excellent photographs at night is now easier than ever. With full control of aperture and shutter speed settings as well as electronic gain (ISO), the photographer has the opportunity to capture images in low light that were not otherwise possible.

However, in many low-light and night-time situations, digital SLR and mirrorless cameras simply do not have sufficient sensitivity to capture adequate images. For one thing, with the ever-decreasing size of pixels, it's remarkable that light sensitivity has not substantially worsened with each new generation of camera (since light sensitivity is directly proportional to detector pixel area). But, fortunately, there's been a lot of camera development on noise reduction so sensitivity has kept pace if not improved slightly with the decreasing pixel area. Regardless of these changes, it remains that a sufficiently long exposure time cannot be used because either there is movement in the scene or the camera is moving (by being handheld or on a vehicle in motion) so long exposure times would result in blurring. For situations such as photographing scenes at night with very little ambient light, or telephoto photography at night at a distance, even the best digital SLR and mirrorless camera will be unable to produce adequate photographs without blur.

LYNRED HEADQUARTERS
DEVELOPMENT & PRODUCTION CENTER

Actipole - CS 10021 - 364, route de Valence
38113 Veurey-Voroize - France
Phone +33 (0)4 76 28 77 00
info@lynred.com

LYNRED ASIA PACIFIC
PTE LTD

5 Shenton Way,
#22-04 UIC Building
068808 Singapore
info@lynred.com

LYNRED
USA

373 US Highway 46W
Fairfield, NJ 07004, USA
Phone +1 973.882.0211
info@lynred-usa.com

NIT (New Imaging Technologies)
Premium SWIR by LYNRED

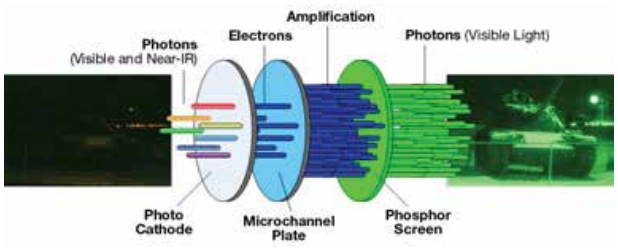
1 impasse de la Noisette
91370 Verrières-le-Buisson - France
Phone +33 1 64 47 88 58
info@new-imaging-technologies.com

AstroScope™ for Canon DSLR Cameras

AstroScope™ for Nikon DSLR Cameras

There is a specific AstroScope™ version that fits between a DSLR or Mirrorless lens and the camera body which amplifies the light that is captured by the objective lens, projecting an amplified (but entirely green or white) image onto the digital camera's image sensor. The result is up to 10 F-stops of improvement, a dramatic change enabling many applications that are otherwise impossible to photograph. The module transforms moonlit or starlit scenes into bright, high resolution images that are easily photographed.

HOW IT WORKS



AstroScope™ transforms dark scenes into bright, high resolution images that can be easily photographed without the need for additional lighting or longer exposure times. The objective lens focuses the minute amounts of available light onto the faceplate of its internal central intensification unit that converts the photons to electrons. The internal electron flux is then amplified and the electrons are accelerated so that when they impinge on the output phosphor, a bright green or white image is created. The image is then focused onto the internal detector of the digital SLR or mirrorless camera.

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LOW-LIGHT IMAGING

The most popular and well known method of performing night vision is based on the use of image intensifiers. Image intensifiers are commonly used in night vision goggles and night scopes. More recently, electron multiplying CCD cameras have become popularized for performing low-light security, surveillance and astronomical observation. High ISO DSLRs and Mirrorless cameras can also be used for some low light applications.

IMAGE INTENSIFIERS

HOW THEY WORK: This method of night vision amplifies the available light to achieve better vision. An objective lens focuses available light (photons) on the photocathode of an image intensifier. The light energy causes electrons to be released from the cathode which are accelerated by an electric field to increase their speed (energy level). These electrons enter holes in a microchannel plate and bounce off the internal specially-coated walls which generate more electrons as the electrons bounce through. This creates a denser "cloud" of electrons representing an intensified version of the original image.

The final stage of the image intensifier involves electrons hitting a phosphor screen. The energy of the electrons makes the phosphor glow. The visual light shows the desired view to the user or to an attached photographic camera or video device. A green phosphor is used in these applications because the human eye can differentiate more shades of green than any other color, allowing for greater differentiation of objects in the picture.

All image intensifiers operate in the above fashion. Technological differences over the past 40 years have resulted in substantial improvement to the performance of these devices. The different paradigms of technology have been commonly identified by distinct generations of image intensifiers. Intensified camera systems usually incorporate an image intensifier to create a brighter image of the low-light scene which is then viewed by a traditional camera.

IMAGE INTENSIFIERS

ADVANTAGES

- Excellent low-light level sensitivity.
- Enhanced visible imaging yields the best possible recognition and identification performance.
- High resolution.
- Low power and cost.
- Ability to identify people.

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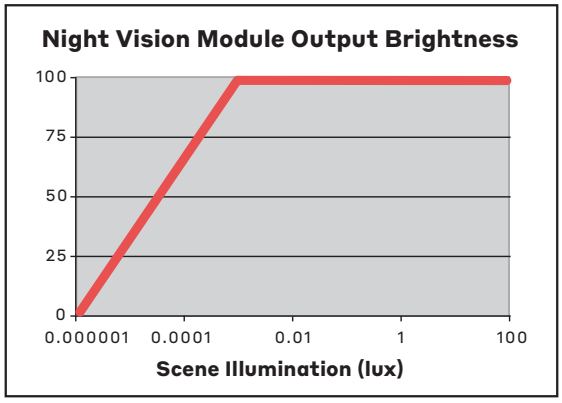
EXPOSURE MODE

Select Manual exposure mode ("M"). Not "Automatic", "Aperture Priority", "Shutter Priority", "Program" or any of the other special modes. In low light, you'll want to manually open the lens iris to permit the most light to fall on the night vision module's sensitive photocathode.

SHUTTER SPEED SETTING

You'll want to set the camera's shutter speed so that it is just long enough that there will be no blur due to motion, usually about 1/30th second. Longer exposure times will usually result in blur (for handheld applications). Shorter exposure times may provide some improvement if excessive motion is a concern but could unnecessarily darken the image due to the reduction of light being acquired from the night vision module's image intensifier. While the output brightness from an image intensifier increases with increasing scene illumination, at higher scene illuminations, the image intensifier's output brightness reaches a maximum value and remains constant as shown in the accompanying chart. (The limitation on the output brightness protects troops wearing night vision goggles from being blinded when viewing a bright light). Since this maximum brightness is not very bright (about 2 foot lumens), it is unlikely that the digital camera's sensor will be saturated as a result. So, faster shutter speeds are not necessary as a method to limit the light accumulation.



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ISO SETTING

While back in the days of photographic film, ISO was a characteristic that described film sensitivity to light, today, ISO is related to electronic gain of the digital camera's sensor. Since increasing the gain will amplify the low light level images, even with a night vision module, lower light scenes will become visible. However, there are disadvantages to setting the ISO too high. As with all electronic circuits at high gain, image noise can degrade image quality. As such, set the camera's ISO to a value as high as you can while still acceptable image noise levels. Usually, the minimum value would be 800, but some cameras deliver perfectly good images at very high ISO settings thanks to image processing algorithms used to help mitigate noise.

MANUAL FOCUS

When using a night vision module, select Manual Focus mode (usually a small lever switch on or near the objective lens mount). Manual focus gives you greater control over how the focus appears. Since night vision modules are generally grainy, the image grain can confuse the SLR camera's focus sensors. Also, realize that these focus sensors will be staring at the output of the night vision module so the grainy artifacts will not be affected by the focus position of the objectivelens (which is located on the front of the night vision module).

USE STABILIZED LENSES

A camera's image stabilization feature permits the photographer to use slower shutter speeds without resulting in blur due to camera shake. Note that there are three primary techniques for image stabilization: optical stabilization (where a small element inside the lens moves in order to stabilize the image projected on the camera's detector), in-body image stabilization, and digital stabilization (which take advantage of extra rows and columns on the perimeter of the detector, shift the image an appropriate amount to stabilize certain types of motion).

Normally, the optical image stabilizers, though more expensive, are preferable since they better remove the blur component of the motion. When using a night vision module, the main disadvantage of the digital stabilization is that the image is blurred on the input of the night vision module resulting in some blur on the intensified output image. So, optical stabilization is preferred.

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LENS APERTURE

The basics still apply for night vision intensified low-light photography. In low-light situations, you'll want to select the fastest objective lens set to the lowest F-stop setting. (The lowest F-stop value indicates that the iris is opened up fully and will gather the most ambient light possible for that lens).

Nikon and Canon offer fast stabilized telephoto objective lenses that are ideal for night vision applications.

INFRARED ILLUMINATOR

Sometimes, even with a night vision module, it's simply too dark to obtain a good quality photograph at night. A dark and cloudy night with no ambient light is one example. Since the night vision module is merely a light amplifier, if there is no light from the stars and sky or from city lights reflecting from clouds, the night vision module will not be effective. In order to photograph without the use of a flash or visible light source, a near-infrared light source can be used that emits light that can be seen by the night vision module but is invisible to the naked eye. Unlike some digital camera sensors which have some near-infrared response, night vision modules are most sensitive to the near infrared wavelength range and consequently these light sources can significantly enhance the night-time image and render night photography possible despite the lack of sufficient visible illumination.

Invisible near infrared illumination can be used to brighten scenes that are otherwise too dark.

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IMAGE CROPPING

Because image intensifiers have automatic electronic gain features to maintain a constant light output, the presence of bright lights in the field-of-view (such as headlights or street lamps) may have the affect of decreasing the unit's overall light gain. This is similar to back-illuminated scenes for un-intensified photography, but even more important because of the significant impact on light gain that could result. This affect may cause the other regions in the image to darken to an unacceptable level. If possible, do your best to exclude non-important bright lights from the field of view.

TURN OFF ALL CAMERA VISIBLE/AUDIBLE FUNCTIONS

For covert night vision photography, don't forget to disable all camera lighting and sound functions. (For example: disable flash, any red eye reduction mechanisms, auto focus assist, LCD preview, and all audible signals).

USE A TRIPOD

When handheld use is not required, select an exposure time long enough that the movement of objects under observation does not result in image blur. As with un-intensified photography, long exposures require that you hold your camera perfectly still to avoid blurring. A tripod is a perfect accessory. If one is not available, try bracing your camera against a stationary object like a tree or wall. In order to avoid the blur that results from finger pressing the camera shutter release (which can cause enough movement to blur a photo), use the camera's timer. A corded or wireless remote shutter release can also be used if the delay in the timer function is not desirable.

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APPLICATION IMAGES

LAW ENFORCEMENT

MILITARY

NATURE

MISCELLANEOUS

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